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ABSTRACT

Computer assisted instruction (CAI) studies with the mentally retarded in the United States and Canada reveal that the retarded benefit from CAI in academic and social skills. Their learning is enhanced to the same extent as that of the nonretarded. CAI can be cost-effective, especially with the reduced costs of mini and micro-computers; however, available computer programs are not developed specifically for this population. An integration of available low cost computers and dedicated high quality computer programs is required if the mentally retarded are to benefit from CAI courseware. (Author/SBH)

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The Instructional Use of CAI in the Education of the Mentally Retarded

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Running head: CAI

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The Instructional Use of CAI in the Education of the Mentally Retarded

Abstract

Computer-assisted instruction (CAI) studies with the mentally retarded in the United States and Canada revealed that the retarded benefit from CAI in academic and social skills. Their learning is enhanced to the same extent as nonretarded persons. CAI can be cost-effective, especially with the reduced costs of mini and microcomputers. However, available computer programs are not developed specificially for this population. An integration of available low cost computers and dedicated high quality computer programs is required if the mentally retarded are to benefit from CAI courseware.

The Instructional Use of CAI in the Education of the Mentally Retarded

Computer-assisted instruction (CAI) is an interactive learning environment in which the computer presents and responds to information given to it by the learner for the purpose of facilitating performance on the part of the learner. This interaction occurs whether the computer is in a drill and practice, tutorial, simulation, modeling, instructional, or Socratic mode. In CAI, the most common mode is drill and practice in which problems are presented by the computer, based on the learner's past performance, and graded according to difficulty. One implication of this definition is that the computer facilitates learning by the user. A computer-learner interaction is not a sufficient circumstance to label a setting as instructional.

In 1976 approximately 2 million students used computers in the classroom in a CAI environment, but only 2% of them were in elementary schools and few were handicapped. There are several possible reasons for this skewed distribution of computer availability to students for use in CAI. One is that the cost of implementing a CAI curriculum is so high as to be affordable only on the higher academic level. Another is that the software (computer program) is not readily available. A third is that there has been reluctance on the part of instructors and administrators to initiate CAI projects, possibly because of the first

two reasons. Fourth, for those persons performing at the lower levels or handicapped, there is little concerted effort to implement CAI courseware. We will briefly discuss possible solutions to these problems throughout this paper.

In the United States there are approximately 9.5 million persons who are severely visually impaired, 2 million who are totally deaf, and 6 million who are mentally retarded. The one handicapped group that has benefitted most from the CAI environment is the hearing-impaired. This is largely due to the efforts of Suppes, von Feldt, Watson, and Culbertson, among others. We suggest that those who wish to embark on a learning program with the handicapped using CAI, read the works of the above authors as well as those of Atkinson, Glaser, Hartley, and Stolurow for their strategies and methodologies.

It has been found that, for the slow learner, CAI is superior to traditional methods of teaching when standardized tests are used as measurements of learning improvement. The same information is learned in less time using CAI techniques and it is cost-effective, not requiring much, if any, of the teacher's time. Also, the students and their parents are generally positive and favorable toward CAI (Jamison, Suppes, & Wells, 1974). Possible reasons for the relative success of CAI for persons who are below grade level are that the computer is infinitely patient, can present material in a highly structured manner, and give positive feedback during learning (Stolurow, 1972).

For the mentally retarded, the learning environment should be one in which information can be presented in a redundant manner, spaced rather than massed with overlearning, and with immediate reinforcement for correct response (Blackhurst, 1965). In spite of the fact that the computer performs all these functions well, especially with individual students, there have been very few studies on the use of CAI to teach the mentally retarded.

Medeiros (1965) discusses the specific advantages and uses of CAI with the mentally retarded and the roles of the teacher and student, so that the novice will have some idea as to the parameters of CAI. Dirr and Anderson (1974) investigated the application of the computer for diagnosing the academic needs of the mentally retarded and prescribing remedial instructional programs in mathematics and language arts. Computer programs were developed to teach consonants, consonant blends, and syllabication.

The most extensive research found using the mentally retarded as the primary target population is reported by Brebner, Hallworth and Brown (1977) with Canadian students. Drill and practice computer programs have been developed to improve arithmetic abilities (counting, adding, and subtraction) as well as the recognition of coins and paper money. Methods of budgeting money and maintaining a simulated bank account are stressed. In the area of reading, letter recognition and matching-to-sample words, up to four letters, are taught. Individualized reading programs for adolescents are being developed. For nonreaders, recognition of limited sets of words is programmed.

Social skills, such as how to apply for a job, how to dress appropriately, how to use a calendar and to tell time are also being taught in Brebner, et al's (1977) CAI program. For those who are physically handicapped, a simplified keyboard, larger hand, foot, and head control switches, under pneumatic control, are used.

Those authors concluded that CAI is an effective method of teaching this population and that it is cost-effective. These conclusions lend credence to the position that, if a teaching technique facilitates learning in nonretarded children, it should also facilitate learning in mentally retarded persons of equivalent mental age, if conducted properly. Emphasis should not be on whether the mentally retarded can benefit through CAI procedures, but on the areas in which they can benefit most.

In other studies, Knutsen and Prochnow (1970) taught their retarded group coin values and how to make change via the CAI technique. Luyben and Brown (1973) presented pictorial representations of words to improve sight vocabulary. Nelson (1972) programmed vocabulary sequences and found that retarded children who received the program performed better than those who did not. When compared with a group of nonretarded children of equal mental age, post-test performance did not differ. This study is the only one we found that employed an experimental design to determine the efficiency of CAI with the mentally retarded when compared with a non-CAI setting and a nonretarded group.

Using programs developed by Suppes (Computer Curriculum Corporation), St. Aubin (1975) tested hearing-, visually-, and learning impaired children

(including the mentally retarded) during a five month period and concluded that there was a correlation between the students' progress and the amount of time spent on the CAI courseware.

While it is necessary to establish whether the amount of time in a CAI course is related to improved performance by the retarded, this result is not unexpected. Suppes has also found this correlation between improvement in learning performance and time spent in a CAI program with nonretarded children (Suppes, 1974). His position is that retarded and nonretarded children do not differ much in arithmetic computation but do differ on arithmetic reading tests, abstraction and the use of verbal information. Thus, the CCC courseware in arithmetic may be suitable for use with the mentally retarded. When comparing the potential learning performance of two handicapped groups (hearing-impaired and the mentally retarded), Suppes states: "The extensive use of computer facilities ... in the teaching of arithmetic to deaf children could also be exploited to advantage in the teaching of arithmetic to retarded children" (p.165). What has yet to be determined is the efficiency of the other strands in the CCC courseware with the mentally retarded inasmuch as they are most deficient in areas requiring verbal and concept formation.

Determining whether the mentally retarded can benefit from CAI to the same degree as nonretarded children in several areas of competency can be an expensive proposition, especially on an experimental or inquiry level. Well-designed and validated program packages

are available and worth investing in, but the support system (terminals, telephone charge and computer time) can make the project prohibitive in cost.

In 1965, when CAI was in its infancy, an IBM computer with sufficient memory to store large CAI programs cost $30,000/month rental. The advent of minicomputers in 1975 reduced the cost dramatically to $5,000-$10,000 for a system that would be sufficient for use for CAI courseware and could be owned by the school system. More recently, with the invention of the microchip, microcomputers can be bought in 1978 for as little as $600 (Commodore PET and Radio Shack TRS-80) although the required memory for large programs is not inherent in those systems. Realistically, microcomputers with enough memory and versatility to perform adequately on a CAI course cost between $2,500 and $3,000 and permit expansion of the systems (terminals, printers, and floppy disks for more memory). Some of the more reliable microcomputer systems that appear to be suitable for this task and that are intended for future expansion are those manufactured by Altair, IMSAI and Southwest Technical Products. If colored graphics are required, the complete Intercolor system is available at $4,000 as is the Apple II at $1,800 without the television monitor. For further information as to the cost of available microcomputers, see the June , 1978 issue of Radio-Electronics.

Our purpose here is not to present a review of microcomputers available to the educator, but to emphasize the lower initial cost of

implementing a CAI system. According to Attala and Tannenbaum (1977), hardware (computer and peripherals) and software (programs that teach) are available for CAI in both mini and microcomputer systems. Their cost is much less than large-based CAI systems and almost any enchancement that is available on large systems is available and cheaper for mini and micro systems. As an aside, it should also be noted that any computer system need not be dedicated to one purpose, viz., CAI. I can also be used to arrange student scheduling, maintain progress records, score tests, and assist with other administrative chores. If viewed as a retrieval system that can manipulate and access stored information, (records, payroll, accounts, library, etc.) the computer can augment and reduce the teacher's and administrator's tasks.

There is no pretense on our part that CAI is the panacea to all of our problems in education or that we envision teacherless classes or a reduction in the teaching staff. Experience has taught us that a "panacea" is only a concept and that, with the advent of new technologies, more expertise, not fewer persons, is required. At issue is whether the investment in money (cost-effectiveness) and time (human investment) will be more than offset by the improved learning performance in the mentally retarded. This has been determined with the hearing-impaired and with the mentally retarded (Brebner, et al., 1977).

Programs of the quality of those by Suppes are not readily available for individual mini and micro systems. However, neither are existing programs tailored to the needs of the mentally retarded,

nor can they be adapted. The solution to the problem of integrating low cost hardware and high quality courseware is not immediate. However, it must be resolved if retarded persons are to benefit from available technology to the same extent as nonretarded persons. Stating a problem, and knowing that it exists, is the first step to an answer.

References

Attala, E. & Tannenbaum, R. S. Minis, micros, and CAI. Journal of Computer-Based Instruction, 1977, 3, D-5

Blackhurst, A. E. Technology in special education -- Some implications. Exceptional Children, 1965, 31, 449-456.

Brebner, A., Hallworth, H. J., & Brown, R. I. Computer-assisted instruction programs and terminals. In P. Mittler (Ed.), Research to practice in mental retardation (Vol. 2). Baltimore: University Park Press, 1977.

Dirr, P. J. & Anderson, S. M. Design and documentation for improved instructional programs for disadvantaged handicapped children. State University of New York at Buffalo, Buffalo, N.Y. 1974

Jamison, D., Suppes, P., & Wells, S. The effectiveness of alternative instructional media: A survey. Review of Educational Research, 1974, 44, 1-67

Knutsen, J. M. & Prochnow, R. R. Computer assisted instruction for vocational rehabilitation of the mentally retarded. The University of Texas at Austin, Austin, TX. 1970

Luyben, P. D. & Brown, B. R. The effects of pictures on a sight vocabulary in rural EMR children. Florida State Department of Education, Crawfordville, FL. 1973.

Medeiros, L. D. Computer assisted instruction for the mentally retarded. Providence College, Providence, RI. 1965.

Nelson, E. M. An evaluation of computer assisted vocabulary instruction with mentally retarded children. Research Report No. 7322. Syracuse City School District, Syracuse, NY. 1972

St. Aubin, R. Evaluation of CAI as used by various handicaps. South Metropolitan Association for Low-Incidence Handicapped. Chicago, IL. 1975.

Stolurow, L. M. Application of psychology to educational technology. Educational Technology, 1972, 12, 9-12

Suppes, P. A survey of cognition in handicapped children. Review of Educational Psychology, 1974, 44, 145-176